

# **Evaluation of Benthic Impacts Associated with Islander East's Modified Offshore Construction Techniques**

## **Islander East Pipeline Project**

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## **1.0 INTRODUCTION**

The Islander East Pipeline Project will involve actions by two separate pipeline companies: Algonquin Gas Transmission Company (“Algonquin”) and Islander East Pipeline Company, L.L.C. (“Islander East”). Algonquin proposes to construct a new compressor station in Cheshire, Connecticut and upgrade existing interstate natural gas pipeline facilities in Cheshire, Wallingford, and North Haven, Connecticut. Upgrades will consist of launcher removal, pipeline retests and anomaly investigations at designated areas along the existing pipeline. Islander East proposes to lease pipeline capacity on facilities owned by Algonquin and construct new interstate natural gas pipeline facilities in North Haven, East Haven, North Branford, and Branford, Connecticut. These facilities will include a new meter station in North Haven, Connecticut, aboveground mainline valves in North Branford and Branford, Connecticut, and a 24-inch-diameter natural gas pipeline between North Haven and Branford, Connecticut. In Branford, the pipeline will enter Long Island Sound where it will cross to Suffolk County, New York.

### **1.1 Original Construction Methods**

As initially proposed in state and federal permit applications, Islander East will install its pipeline under the Connecticut shoreline using the horizontal directional drilling construction technique. The drill entry point will be located in an upland area approximately 700 feet from the shoreline. The length of the drill will be approximately 4,200 feet, and will avoid sensitive aquatic resources including tidal wetlands, rocky shorefronts, intertidal flats, islands, and shellfish beds under the jurisdiction of the Town of Branford. The horizontal directional drill (“HDD”) exit point will be dredged with conventional bucket dredge equipment to accommodate pipeline installation. In its original proposal, Islander East planned on temporarily sidecasting dredged spoil from the transition trench and exit hole on the seabed. The pipeline would then be installed for approximately 1.1 miles by dredging a trench, sidecasting spoil, installing the pipeline, and then backfilling the trench using the sidecast spoil. Beyond the dredge section the pipeline would be fabricated and lowered to the seafloor and then plowed into the seafloor with two passes of a subsea plow, followed by a single backfill plow pass.

Several environmental and engineering investigations were conducted to determine the pipeline route, preferred installation methods, sensitive habitats, and adverse impacts associated with the proposed project. These investigations included marine geophysical and geotechnical investigations, ecological investigations, a planimetric survey, and an environmental sampling survey. The marine geophysical and geotechnical investigations included a hydrographic survey, side scan sonar survey, sub-bottom profiling, jet probing, magnetometer survey, vibratory coring and rotary coring. Ecological investigations included a benthic survey, wetland delineations, and vegetative surveys to determine the presence of reported threatened and endangered species. The environmental sampling survey consisted of surface water and sediment sampling and analysis. A series of sediment transport studies have been completed to determine the nature of potential sedimentation associated with the proposed pipeline installation.

## **1.2 Alternative Construction Methods**

Islander East is continuing the process of obtaining permits for the construction and operation of the Islander East Pipeline. As part of this effort, Islander East continues to evaluate potential construction methods, both from an engineering feasibility and environmental standpoint. Several of the alternative construction methods/approaches have been investigated, including: placement of dredged spoil from the exit hole and Connecticut dredge section into barges for temporary storage or off-site disposal rather than sidecasting; burial of the pipeline to provide 1.5 feet of cover; and backfilling the Connecticut dredged trench with engineered backfill. As discussed below, sediment transport and deposition analyses were conducted for these to identify the extent and thickness of sediment deposition resulting from the alternative construction methods. Following the new sediment modeling results is a discussion of the marine biological resource impact changes that result from use of these revised methods compared to the originally proposed methods.

## **2.0 REVISED SEDIMENT MODELING RESULTS**

In the spring and summer of 2002, Dr. Frank Bohlen of the University of Connecticut and Applied Science Associates, Inc (“ASA”) performed sediment transport and deposition modeling and analyses related to the proposed construction methods that had been presented in the Federal Energy Regulatory Commission (“FERC”), Connecticut Department of Environmental Protection Office of Long Island Sound Programs, Connecticut Siting Council, and United States Army Corps of Engineers applications. These analyses included depth of sediment deposition and areal extent of sediment deposition resulting from dredging and spoil erosion along the HDD exit hole as well as the trench dredging. The sediment deposition modeling indicated that sediment deposition could occur in an area around the HDD exit hole up to 90 mm thickness at about 70 feet and rapidly thinning out to 30 mm thickness within 400 feet (ASA, 2002a). For the dredged trench, the ASA modeling indicated that within 50 feet of the trench/spoil the maximum deposited sediment thickness could reach 30 mm.

In Fall 2002, ASA performed additional sediment transport and deposition analyses of several potential changes in construction procedures to assist in the determination of benefits to the environment if the construction changes are adopted. These results indicated a substantial decrease in area of sediment deposition and depth of deposited sediments (ASA, 2002b) for both 3-feet and 1.5-feet depth of cover scenarios with storage of spoil in material barges (Table 1).

Table 1: Summary of February 2003 Modeling Results					
Depth of Cover Scenario	Total Dredge Volume (cubic yards)	Loss from Dredge (percent)	Loss from Barge (percent)	Area Covered by Greater Than 1 mm (acres)	Area Covered by Greater Than 3mm (acres)
3 feet	+/-55,000	3	1	38.6	4.0
1.5 feet	+/-27,840	3	1	14.0	0.0

### 3.0 BENTHIC HABITAT IMPACT CHARACTERIZATION

#### 3.1 Existing Benthic Community

Several efforts were undertaken to characterize the benthic habitat and communities associated with the pipeline corridor in Long Island Sound. A brief summary of the results of diver observations, grab sampling and underwater video used to obtain information, in the Connecticut nearshore waters (*i.e.*, in waters less than 20 feet deep), is presented below.

##### 3.1.1 HDD Exit Hole Area

Based on side scan sonar and geotechnical data, the sea floor in the HDD exit area is comprised of fine-grained sediments (fine sand, silt, clay, shells and shell fragments), with several rocky outcrops in the vicinity. This is consistent with the diver observations which found sandy/silt in the exit point area. Sediment grain-size analyses from the vibracore sample taken at the exit point indicate that the sediments are comprised of 90 percent silts and clays by weight and have a high water content of about 77 percent.

Soft sediment communities in the HDD exit area are dominated by several burrowing and tube building polychaetes, including *Clymenella torquata* and *Nephtys incisa*, and several bivalve species including *Mulinia lateralis*, *Pitar morhuanna* and *Nucula annulata*. Other studies show that these species are common in the nearshore habitats of Long Island Sound (McCall 1977, 1978, Swanson 1977, Hoehn and Morris 1977, Rhoads et al 1978, Rhoads and Germano 1982, 1987).

No hard clams (*Mercenaria mercenaria*) were found in any of the quantitative bottom grab samples taken in this area. Diver samples indicated that there were no live hard clams or live oysters or oyster shells at sampling stations located near the HDD exit area. No live individuals of shellfish resource species (hard clams and oysters) were found in the samples, suggesting that, at best, low density populations occupy this area.

There are several rocky outcrops that occur within 1000 feet of the HDD exit hole, primarily in a northerly direction, toward the shore. Based on the side scan sonar survey, medium and coarse-grained sediments are found adjacent to these rocky outcrops. The benthic community at one rocky outcrop sampled in the HDD vicinity was characterized by abundant macroalgal growth, various hard substrate invertebrates such as sponges and bryozoans, as well as a population of blue mussels (*Mytilus edulis*). The other rocky outcrops in the vicinity likely support similar

hard substrate communities. The video survey indicated that rocky subtidal areas in this vicinity were silted.

The video survey results for the HDD exit hole area indicate that the predominant habitat was a soft, bioturbated mud. Overall, the survey data indicates that the sea floor in the vicinity of the HDD exit is comprised predominantly of mud with some rocky habitat, which contain a typical assemblage of benthic plants and animals that are commonly found in other nearshore areas of Long Island Sound.

### **3.1.2 Connecticut Dredged Trench Area**

From the HDD exit hole, a trench is proposed to be excavated for the pipeline from about MP 10.9 to MP 12.0, using a bucket or clamshell dredge. This relatively short section of the pipeline corridor traverses an area that is primarily fine-grained sediments (fine sand, silt, clay, shells and shell fragments). Sediment grain size analyses indicate that the sediments are comprised of silts and clays (90% - 95% by weight) and have high water content. Information from diver observations and grab samples taken along this portion of the corridor are consistent with the side scan interpretations and vibracore analyses. Grab samples indicate the sediments are fine gray and brown muds with shell hash. In some areas the mud is black and sticky, consistent with anaerobic conditions.

Based on quantitative grab samples, the soft-sediment benthic community in this section of the pipeline corridor is spatially similar and dominated by several species of polychaetes, including *Nephtys incisa* and *Euclymene sp.*, the gastropod *Retusa canicualta*, several smaller bivalve species including *Nucula annulata*, and in some areas, *Yoldia limatula* and *Tellina agilis*. Based on samples taken by divers, no live hard clams or oysters were found at most of the stations. However, hard clams (*Mercenaria mercenaria*) at densities of approximately one individual per 0.25 square meter, were found at two stations located 1,750 feet and 1,000 feet to the west of the proposed pipeline corridor. Diver observations also corroborate the grab sample data, indicating that the benthic communities along this section of the pipeline corridor are characterized by several larger and deeper dwelling polychaete and bivalve species.

Results of several video transects across the pipeline corridor in the dredged trench section indicate mostly mud habitat, with some areas of amphipod tube mats, shell hash, and areas of polychaete and burrowing anemone tubes. One transect crossed an area of what appeared to be tracks indicative of anchor drag marks. Some oysters and algae were observed in areas of shell hash.

## **3.2 Revised Impact Analysis**

Using the benthic community and habitat characterization information summarized above, along with the sediment transport modeling results presented in Section 2, the following sections present the revised evaluation of the potential impacts from the exit hole and trench dredging activities near the Connecticut Shore of the pipeline corridor.

### **3.2.1 Impact Area**

Under the revised construction concepts, there is a drastic reduction in the area directly disturbed by dredging the exit hole since the spoil will not be placed on the seafloor. Using data included in the FERC Final Environmental Impact Statement (“FEIS”), it is likely that the impact area will drop from slightly less than 24 acres to approximately 8.4 acres. Under the revised construction concepts, the area directly disturbed by dredging the trench between the exit hole and the start of the plow section, a distance of about 1.1 miles, will be greatly reduced. With consideration given to the 1.5-foot depth of cover scenario, which will result in a narrower trench, and using data included in the FERC FEIS, it is likely that the impact area associated with the dredged trench will decrease from around 115 acres to approximately 5.6 acres.

When requested to provide an initial review of the modeling results for the modified construction methods, Dr. Zajac, an independent marine biologist consulting on the project, wrote:

“There will be no burial and smothering of sea floor areas adjacent to the HDD exit area and dredge trench portion of the pipeline with the dredge spoil, reducing the overall area of direct, severe impact. The removal of dredge spoils will eliminate winnowing of sediment on a continual basis to surrounding habitats, and more critically, the potential for severe erosion in the case of a storm event during the construction period” (Zajac, 2003).

If the trench is dug shallower, to accommodate the 1.5-foot depth of cover scenario, there may be even fewer direct impacts, as the trench will be narrower (shorter horizontal width with a decrease in vertical depth based on the ultimate resting state of the side slopes) and there likely will be less slumping of the sides of the trench, and therefore less disturbance to habitats and communities along the trench. Fewer organisms within these slumped sediments will be affected during pipelay and backfill.

### **3.2.2 Sediment Deposition**

In regards to sediment deposition, the amount of sediment which is predicted to be deposited onto the sea floor is considerably less than in the originally proposed construction scenarios. In the new scenarios, it is predicated that no areas will have deposits greater than about 5 mm in thickness, and in the 1.5-foot depth of cover scenario it is predicted that no areas will have sediment deposition greater than 3 mm in thickness. Again, Dr. Zajac writes, “Considering only the maximums, and if the predictions are correct, this degree of sediment deposition onto the sea floor should have little impact on sea floor habitats and communities, and may approach background/natural levels of sediment resuspension and deposition in the area”.

There are a number of factors associated with the revised construction scenarios that result in this negligible level of impact. Because construction will be occurring in winter months, most benthic species will not be recruiting during this time and as such there should be little burial of the more sensitive newly settled individuals. Many adult infaunal organisms can adjust their living position within sediments. With deposited sediment thickness estimates at less than 5 mm for the 3 feet depth of cover scenario and less than 3 mm for the 1.5-foot depth of cover scenario,

there will be little to no stress effects on infauna. Mobile epibenthic forms may either move away from the depositional areas or be little affected by the relatively short duration and localized increases in suspended sediments. Reversing tidal currents and dredge movement along the pipeline corridor limit sediment plume exposure to organisms at any one location to around 6 hours.

Further, based on the ASA sediment deposition modeling (ASA, 2002b), the predicted pattern of deposition indicates that suspended sediments will be deposited on the sea floor in a patchy manner, following the oscillations of the tide. In the 3-foot depth of cover scenario, although there is a continuous band of deposited sediments along the pipeline trench, there are areas where the deposition is minimal (<1 mm) and narrows toward the trench. These narrow and minimal deposition areas may be impacted very little and may act as a source of colonists to the trench area. In the 1.5-foot depth of cover scenario, sediment deposition is predicted to be even patchier, with deposition thickness of 2 to 3 mm limited to the HDD exit hole area. Under this scenario, with nearly all of the dredged pipeline trench adjacent areas receiving 1 mm or less of deposited sediments, no mortality is expected and stress factors will be minimal.

### ***3.2.3 Engineered Backfill***

As an option to placing the dredged spoil back in the exit hole and dredged trench, Islander East is considering the use of engineered backfill. Given the volume of material involved, this scenario is only being contemplated in the event of the 1.5-foot depth of cover scenario. Rock or gravel of less than 4 inches in diameter is being considered because of its cost, ease of handling, benefits as cover for the pipeline, and potential habitat benefits. Engineered backfill has value as hard substrate for attachment of organisms and plants, which could promote habitat diversity. The conversion of mud substrates to a more rocky material will have minimal impacts on soft sediment species populations because it represents a very minor percent decrease in availability of mud substrates that will not affect Long Island Sound organisms at the population level.

Furthermore, given the depositional nature and nephroid layer movement in the area, depending upon tide currents, frequency and magnitude of storm events, and local bottom topography, fine sediments may start to fill in the interstices of the engineered backfill, with the potential for some areas to become entirely covered with silty sediments over time. In time, the rock backfill area along the length of the pipeline trench will become a mosaic of several substrate type combinations. This substrate mosaic has the potential to increase habitat diversity, supporting greater species richness than a single substrate type.

## **4.0 CONCLUSIONS**

In an effort to reduce environmental impacts, Islander East developed and is evaluating several modifications or revisions to the Connecticut nearshore Long Island Sound construction procedures. As discussed above, these revisions will result in substantial reduction in both area of seafloor directly affected by bucket dredging and spoil sidecasting and area of seafloor indirectly affected by sediment transport and deposition.



The barging of spoil with the 1.5-foot depth of cover scenario will reduce the disturbed area from approximately 139 acres to 14 acres in the Connecticut nearshore waters less than 20-feet-deep. Further, with the 1.5-foot depth of cover scenario, the use of engineered backfill may increase biological diversity, and has the potential to improve conditions for two valuable commercial species, oyster and lobster. In summary, Islander East continues to work with resource agencies to refine the project to maximize its overall benefits to the environment and the citizens of Connecticut and New York.

## **5.0 REFERENCES**

- ASA, 2002a. Dredged Material Mound Dispersion Analysis Using LTFATE. Report prepared July 2002 for Natural Resource Group, Inc. Seven pages.
- ASA, 2002b. Results of SSFATE Model Simulations, Nearshore Connecticut, Long Island Sound. Report prepared February 2003 for Natural Resource Group, Inc. Eight pages.
- Zajac, Roman. 2003. Memorandum submitted January 26, 2003 to Paul Martin, TRC Environmental Corporation. Two pages.